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FOUNDRY TRADE JOURNAL
Established 1902
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Vol. 69 Thursday, January 14, 1943 No. 1378

F.O.C.

Most foundry executives are mild grumblers at the various Orders imposed upon them by the Government departments, and only a few accord bouquets for the useful services available to them from this same source. If a contract assumes proportions greater than can be absorbed by the foundry, then recourse can be had to the Regional or District Capacity Offices of the Ministry of Production, whose job it is to find a suitable sub-contractor. Conversely, if a foundry requires additional orders so as to work to a hundred per cent. capacity, it is the task of this organisation to solve the problem. Equally useful is the Department of the Senior Economy Officer, of the Ministry of Supply, which functions in two separate directions. Primarily, the department is organised to help manufacturers to overcome difficulties due to certain materials being in short supply and their replacement by others more plentiful. By getting first-hand information as to the situation in the actual works, the department can, and does where necessary, negotiate with the Services for appropriate modifications in their specifications. The second is the organisation of a disposals branch. Instead of waiting until the conclusion of hostilities to discover that changes in methods of warfare rendered obsolete large quantities of goods of all kinds, this department is charged with accelerating their return to the factories as wholesale raw material. For this purpose storage departments are maintained at key points, where arrangements are made for the reception, sorting, segregation and reprocessing of all types of surplus materials, mainly of Government origin, but where suitable privately-owned surpluses will be taken over. Perhaps the most important function of this department from the angle of the foundry executive is the monthly publication of a National Stock List. Herein are listed stocks of materials rendered available to industry through the emendation or cancellation of contracts. Not only is material listed, but also quantities of plant and machinery. Naturally, for maximum success, private firms should co-operate by sending details of their surplus plant and materials to the Directorate of Economy (National Stock List), Berkeley Court, Glentworth Street, London, N.W.1. Parties interested in the acquisition of stocks make their bargains as private concerns, but sales are, of course, subject to the general principle that controlled prices must not be exceeded. Finally, there is a service which possesses no publicity department, and those giving it may be attached to any one of the Government departments. We often meet in trains and hotels, technicians whose job it is to go from one factory to another giving specialised advice on production problems. They have an interesting, but worrying, job of attempting to solve, often very successfully, the problems found too difficult for the works staff. For these service men there is no such thing as a cut and dried remedy, but, like the pathologist, the dose to be injected must vary with the condition of the patient. Whilst desiring to bring to the notice of executives the scope and existence of these laudable "free" services, it seems worth while pointing out that they are paid for very largely by industry, they do not enter into the category of "Owt for nowt," for they certainly are "worth having."

Though not directly Governmental, the Directorate of Economy (Disposals) has in a number of regions organised a mutual aid scheme, which operates much on the lines of the National Stock List, but much more quickly. Here the foundry industry could usefully co-operate by making available in their locality a list of their moulding boxes not in commission, and lease-lending them to a nearby foundry where they are really wanted, a major contribution is made to the war effort in the form of man-hours and materials.

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SCHOOL OF ENGINEERING RADIOGRAPHY

Kodak, Limited, have organised a school of industrial and engineering radiography to provide instruction in X-ray work, film processing, optical experiments, etc. The school, which was opened on January 6 by Prof. E. N. da C. Andrade, F.R.S., is the first of its kind in this country and is designed to provide operators with an introductory knowledge of radiographic technique prior to entering industry. The fundamental instruction given is planned to meet the special requirements of the Aeronautical Inspection Directorate, of Lloyds, and of certain industries. Classes are restricted to a maximum of six students to permit individual tuition. The school is fittingly equipped in a section of the Kodak factory. That its opening has been well received by industry is shown by the fact that students have been registered already as far forward as April.

In his introductory speech at the opening of the school, Dr. V. E. Pullin, C.B.E., recalled that in the early days of engineering radiography it was extremely difficult to get anyone to take X-ray inspection seriously. No one regarded it as other than a scientific toy, and no one would have dreamed of applying it to any serious inspection process. In 1917, various authorities in America flatly refused to deal with the subject as a serious proposition. Recently stressed castings had been used in the aircraft industry to an extent quite undreamed-of a short time ago, and there is no doubt that this policy was largely due to the fact that X-ray inspection offered a reliable safeguard. For aircraft castings, this particular form of inspection had had to be partly standardised, because the principles involved were so vital that any departure from a strict standardisation of method was quite unthinkable if real reliance was to be placed upon the method.

There were some 40 or 50 firms in this country who are doing radiographic inspection of aircraft parts, continued Dr. Pullin. Several hundred thousand aircraft castings were radiologically inspected every month. The whole of this radiological inspection of aircraft castings was done under the control of the A.I.D. and was carried out under the most strict and systematic conditions regarding method and technique of radiography. Every type of Class I and Class II aircraft casting had a specialised technique of its own worked out in the A.I.D. and that particular technique was applied throughout the country in a perfectly systematic manner. Furthermore, in the radiography of the high-class welding demanded in Class I Pressure Vessels, X-ray inspection was a *sine qua non*.

To a very large extent this method of inspection depended on the integrity and carefulness of the radiographer. It could not be defined once and for all and left to the accuracy of a machine. It depended on the honesty, skill and knowledge of the person doing the work. Hence, the value of the new school. The syllabus of the school had been designed most carefully to supply those scientific fundamentals upon which a superstructure of specialised radiographic skill can be erected in an *ad hoc* manner. This was the purpose of the school—to teach soundly, scientifically and properly the principles underlying the various methods of radiography.

Formally opening the school, Prof. E. N. da C. Andrade, F.R.S., pointed to the widespread realisation, at the present time, of the importance of the X-ray method of examining the engineers' materials. Throughout the Services, but particularly in the M.A.P., X-rays were used in development and inspection—in development to control the soundness of particular structural designs and in inspection to examine structures, assemblies and components for hidden flaws.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

FOUNDRY TRAINING

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—From the opinions expressed through your columns recently on training the foundry apprentice, there is every indication that the matter is receiving the attention it deserves. The Institute of British Foundrymen in conjunction with national and local education authorities are doing good work in providing technical training where foundry schools are in operation. Unfortunately, however, such schools are few in number and exist only in the larger industrial areas.

There are therefore no facilities in the smaller towns for apprentices to receive such training. The equipping of a foundry school involves considerable expense, and therefore it is not a practicable proposition to open such schools in small areas. Foundry technical training should be made a part of the apprenticeship, and where there is no school in operation, employers could assist in joining forces in arranging for their apprentices to receive training on their own premises. It is only by giving all apprentices the necessary training that the industry will reap the fullest harvest of skilled moulders and executives in future years.

The matter of instructors is also an important one, for not only must they be highly skilled practical men and technicians, but they must also possess teaching abilities. It is suggested that men selected for such positions could work an area comprising the towns where foundry schools do not exist. This arrangement would provide technical training for all apprentices and would furthermore stimulate interest and most definitely raise the status of the foundry apprentice.

The subject is highly involved, and concerns mostly the employers as they are in the position to make the greatest contribution towards its success. Their support, however, would pay good dividends in providing the foundry industry with fully skilled personnel; and at the same time giving every apprentice an equal opportunity to rise to executive positions.

Yours, etc.,

R. F. COATES.

94, Brunswick Road,
Ipswich, Suffolk.

ELECTRIC FURNACES IN THE MANUFACTURE OF HIGH-DUTY CAST IRON

Principal Factors Covering Selection and Operation of these Furnaces Indicated by Personal Experiences

By T. R. TWIGGER

(*Continued from page 7.*)

Obviously the amount of cold material which can be added is controlled by the amount and frequency of metal withdrawn. This method has the advantage that the bulk of metal is melted cheaply in the cupola, and a large throughput is obtained from one electric furnace. Synchronisation between electric furnace and cupola is arranged, and is illustrated in the following timetable.

TABLE II.—*Synchronisation Scheme between Electric Furnace and Cupola.*

ELECTRIC FURNACE.	a.m.	CUPOLA.	a.m.
Melting commences ..	7.0	Blow commences ..	7.45
		Metal tapped ..	8.5
First metal added from cupola	8.15	First tap into 'Lectro-melt	8.15
First metal tapped ..	8.30	Cupola off	12.15
Last metal tapped at	12.40	Last metal withdrawn	12.30
Leaving approx. 7 cwts. in furnace.		Blowing recommences	1.15
First metal added ..	1.30	Metal poured into 'Lectromelt ..	1.30
First metal withdrawn	1.45	Cupola shut down ..	4.45
Last metal added ..	5.0		
Last metal withdrawn	5.45	Last metal withdrawn	5.0

Details of the first cold charge are given in Table III and for the duplexed material in Table IV.

Apart from the first heat of the day already referred to, cold melting is practised in some cases—notably on a special iron of great heat and corrosion resistance, having approximately 1.7 per cent. carbon and 30 per cent. chromium. Such material made under the trade name "Bricrome" can be melted in a rocking arc furnace, but on account of the high casting temperature required the 'Lectromelt furnace is preferred.

This very low carbon iron is one which it would be difficult, if not impossible, to produce from a cupola.

Linings

High-duty cast irons usually necessitate high pouring temperatures, but steel melting temperatures are usually not necessary, therefore wear and tear on the linings is usually less severe than in steel furnaces; nevertheless, lining costs represent an appreciable item in operating costs and must be controlled—not only must the actual cost of lining itself be studied, but also the loss of output and inconvenience in production due to a furnace being out of action if frequent relining is necessary.

(*a*) *Rocking Arc* (*350 lbs. cold charge capacity*).—Most of the materials dealt with have not necessitated a basic lining, therefore experience has been confined to sillimanite bricks, and rammed ganister of good quality. The latter is considered by far the better proposition. Since the furnaces are sometimes operated on cold melting (using either a complete cold charge, or first melting the solid part of the charge then adding molten metal), or sometimes entirely on duplexing molten metal with relatively small amounts of solid material, it is not possible to give precise details of lining life in terms of number of heats, but it can be stated that with a small amount of daily patching round the door and internal patching weekly, and using charges consisting of 50 per cent. solid material and 50 per cent. molten metal, a life of 1,000 heats is expected. The design of this type of furnace lends itself to the use of interchangeable shells which greatly minimises shut-down time when relining is necessary.

(*b*) *'Lectromelt* (*15 cwts. nominal cold charge capacity*).—This furnace has been operated on the basis of one cold charge, with subsequent molten metal additions and withdrawal as previously described, and with a basic lining, which was considered desirable in view of the furnace occasionally being used for the high chromium alloy previously referred to. Experience with the particular monolithic lining so far tried indicates that with a certain amount of daily patching, the life is 30 working days before it is necessary to reline the side walls, the amount of metal dealt with during this period being approximately 10½ tons melted cold and 160 tons duplexed. With a monolithic lining side wall repair consists of removing the roof ring, inserting a steel former and ramming the lining material, usually bonded with wire nails. No lengthy dry-out period is necessary, and the furnace can be put into immediate use. The roof ring, which is water-cooled near the steel casing, is constructed of sillimanite bricks set in sillimanite cement, and a life of approximately 50 working days is obtained.

Charging, Melting and Slagging

(*a*) *Rocking Arc.*—When charging the rocking arc furnace, heavy material such as pig-iron is placed on the bottom and smaller material on top; if charging very light material the charge may surround the electrode, and this is not detrimental. The later editions of these furnaces are equipped with automatic rocking gear mechanism by which the initial angle of rock and rate of subsequent increase follow a predetermined setting.

On normal types of cast iron no slag-forming materials are added. A certain amount of slag is formed, this is usually thick and no trouble is experienced when tapping metal through the small door aperture. At the end of a heat—or more usually at

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the end of a day, the slag is emptied by removing the door, rotating the furnace so that the door is at the lowest position, and striking the arc for a few minutes.

(*b*) *'Lectromelt.*—When melting cold charges, any heavy material is placed on the hearth, and the top layer always consists of fine scrap. Under these conditions direct shorting is avoided, which would be the case if large lumps were near the electrodes before the bath is formed. Four voltage tappings are provided, melting commencing on No. 1 with No. 2 used when the bath is formed. Nos. 3 and 4 are used for maintaining temperature when molten. In view of the basic lining it is necessary to provide a basic slag

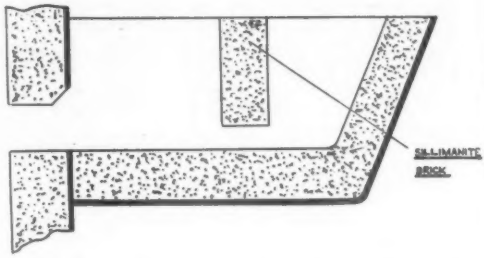

FIG. 9.—POURING SPOUT AND SLAG BAFFLE FOR THE 'LECTROMELT FURNACE.

TABLE III.—*Electric Furnace Charge Sheet* (*Solid Charge*). October 28, 1942

Cast No. Z.24. *Centrifugal Foundry. Furnace No.* 4. (*'Lectromelt.*)

Mix. No.	Charge.	Alloys, etc.	Time start.	Time charged.	Time tapped.	No. of charges.
Alloy 20	3½ cwt. 233 scrap ..	Fe-Si .. .. 3 lbs.	6.50	6.50	8.10	—
	2½ „ No. 1 scrap ..	„ Mn .. 1 „	Meter	Meter	Meter	1
	1 „ B.M.C. scrap ..	„ Chrome .. 6 „				
	7		136,370	—	136,610	—

12 lbs. lime, 7 lbs. anthracite.

	T.C	Si	P	Mn	Ni	Cr	Mo
Com. cal.	3.23	2.65	0.33	0.81	—	1.09	0.85
Assumed loss	0.23	0.19	—	0.04	—	0.06	0.02
Com. expect.	3.00	2.46	0.33	0.77	—	1.03	0.83
Com. actual	2.98	2.50	0.34	0.76	—	1.01	0.82
Actual loss	0.25	0.15	—	0.05	—	0.08	0.03

Current consumption 700 units per ton.

and reducing conditions in order to avoid attack on the lining by oxidised silicon. When commencing with a cold charge, 12 lbs. crushed lime and 7 lbs. crushed anthracite are added, subsequently some slag is removed every two hours and the slag renewed by the addition of 10 lbs. lime. Before the mid-day break a further 7 lbs. of anthracite are added. The melting time is normally 1½ hrs. (first heat) and after the pouring temperature has been reached the metal may stand 30 min. without appreciable loss of temperature. The slag formed by the additions mentioned is capable of effecting some desulphurisation as is shown by the following figures, although desulphurisation is not deliberately sought.

Sulphur Content.

Cupola metal, 9 a.m., 0.112 per cent.
Electric furnace metal, 10 a.m., 0.058 per cent.
Cupola metal, 3 p.m., 0.083 per cent.
Electric furnace metal, 4 p.m., 0.059 per cent.

Under the system of continuous duplexing some provision is necessary to avoid the slag entering the ladle when withdrawing the molten metal. This is achieved by fixing the slag brick, shown in Fig. 9, in the pouring spout as shown in the illustration. This slag baffle is not a complete slag trap, but in practice the amount of slag poured before the level of metal is above the bottom of the slag baffle is exceedingly small. A complete slag seal would necessitate a pool of molten metal in the slag spout and this is considered undesirable.

Operating Costs

Claims are sometimes made that electric furnace cast iron can be produced at a cost equal or less than that of cupola metal. This may be true under particular conditions, but only where very cheap raw materials are available for the electric furnace. Costing systems, in particular the allocation of overheads, vary so much between different plants that no attempt is here made to give actual metal costs. In the author's opinion it is desirable always to incor-

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porate the cost of melting in the "cost at spout" even if this involves a special allocation of overheads to cover the depreciation, etc., of the particular furnace. Sufficient has been said about lining life to furnish a basis of comparison by anyone interested. Other details bearing on operating costs may be of interest.

Electrodes and Current Consumption

Since mixed cold melting and duplexing is the rule no figures per ton melted can be given. Information on this subject is given in the section on arc furnace melting in Robiette's book already mentioned.

furnace operations and assists the operator who handles metal along the runway from the cupola, in pouring metal into the furnace, and also assists the operator who handles metal withdrawn from the furnace for transmission via the runway to the casting machines.

Cooling Water

(*a*) *Rocking Arc.*—In view of the small amount required to cool the electrode holders, a closed circuit, involving a circulating pump and overhead tank, serves two furnaces, thus only the cost of pump operation is involved.

(*b*) *'Lectromelt.*—This requires a fairly large volume of water, since the roof ring, electrodes, glands, and furnace doors must be cooled. With a closed circuit a water cooler would be necessary. In the author's works adversity arising through a spring which filled a concrete underground shelter, and which kept it full, despite all attempts to keep it empty, was turned to good account as a supply of cooling water, a circulating pump being the only operating cost.

TABLE IV.—*Electric Furnace Charge Sheet (Liquid Charges).* October 28, 1942

Cast No. Z.24. *Centrifugal Foundry. Furnace Sheet No. 4. ('Lectromelt.)*

Mix No.	Charge.	Alloys, etc.	Time start.	Time charged.	Time tapped.	No. of charges.
Alloy 20	Add to 1st charge melted 2¼ cwts. cupola mix. + 20 lbs. steel	Chromex .. 1½ lbs. Fe-Mo .. ¼ lb.	— —	— —	— —	— —
			Meter	Meter	Meter	42
			136:610	—	137,640	—

7 lbs. anthracite added during mid-day break. Slag renewed with 10 lbs. lime after each slagging.

	T.C	Si	P	Mn	Ni	Cr	Mo
Com. expect.	2.95	2.40	0.32	0.80	—	1.05	0.85
Com. actual	2.96	2.32	0.32	0.82	—	1.04	0.85
Actual loss	—	0.08	—	—	—	0.01	—

Current consumption 184 units per ton.

Sufficient data of current consumption are available to justify the following figures:

Rocking Arc:

Cold melting, 1st heat, 850 units per ton.

Subsequent heat, 750 units per ton.

'Lectromelt:

Cold melting, 1st heat, 710 units per ton.

Duplexing, 200 units per ton.

These figures are considered satisfactory in view of the operating conditions. Lower current consumptions could no doubt be obtained on larger furnaces. On the other hand, consumptions would be higher on lower carbon materials. Current is available for the electric furnaces referred to at 0.5d. per unit.

Labour

(*a*) On the 350-lb. rocking arc furnace one operator weighs out metal charges, maintains current load by hand operation of electrodes, controls pouring, and attends to lining repair.

(*b*) On the 'Lectromelt furnace, one operator with some assistance in preparing the charge, controls

Depreciation

This important item, which is high for any type of electric furnace, should be allocated to melting costs. When duplexing, the large throughput results in a low cost per ton, but for straight melting the depreciation per ton is necessarily high.

Electric Furnace as a Receiver

To ensure a continuous supply of molten metal for special requirements, three crucible furnaces have been operated, lately on creosote-pitch oil. Such figures as are available indicate that the cost of storing in an electric furnace is lower than for crucible operation—allowing for the much higher depreciation charges on the electric furnace. In addition, the

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elimination of breakdowns due to crucible failure is an important point.

Conclusion

"Before closing we must sound the warning that the electric furnace is not a cure-all for the many ailments to which the iron foundry is heir. Its adoption is not a surcease from all care, for if not attended by experienced and intelligent metallurgical supervision, it can readily become the source of the greatest worry and disappointment. Efficient and versatile as the electric furnace may be, it is comparable to a highly developed machine that can be placed with assurance only in the hands of trained and intelligent operators. It needs the help of sound metallurgical sense, and well directed thought and study." These words which form the closing paragraph of Elliott's Paper 20 years ago can well end the present Paper, which it is hoped may prove of interest and help, and result in exchange of experiences which the author would appreciate.

Finally, thanks are due to the author's colleagues for ready assistance, and to the directors of the British Piston Ring Company, Limited, for permission to give this Paper.

DISCUSSION

High Temperature Not Sought

Opening the discussion, MR. E. HUNTER said there had been no mention of metal temperatures. He would like to know what degree of superheat Mr. Twigger obtained. The question of maintenance costs was also of interest. If the meeting could have an indication of how electric furnace maintenance costs compared with those in cupola working he thought it would be of value. The lecturer had stated that light material was placed on top of the charge. Did he mean turnings or borings, and if such material was not available what would he use?

MR. TWIGGER, in reply, stated that the molten metal temperature required was not outstandingly high. If the metal came from the cupola spout at 1,380 or 1,400 deg. C. there would be no difficulty in getting it into the 'Lectromelt furnace. The metal would be taken out at about the same temperature. There was no need to approach steel furnace temperatures. As to maintenance charges, he could give no figures, but he thought that with a furnace in regular use over a year the cost of maintenance would be two or three times that of a cupola. Almost any light scrap would be suitable to place on top of the charge. Very light runners would do if nothing else were available.

MR. G. R. SHOTTON thought that Mr. Twigger must be one of the very fortunate people if he had no difficulty with returned scrap. If, as he understood, about 2 cwts. of metal was added and tapped every 10 min., to what extent was the bath being diluted?

MR. TWIGGER emphasised that a great deal of care was taken in segregating different types of scrap. Scrap from each mixture was reallocated to the same mixture. In the case of the centrifugal foundry, all castings from each specification were marked with a distinguishing colour on the base. With regard to the weight of metal in the 'Lectromelt furnace, they started with a 7-cwt. charge at the beginning of the day. Obviously, if the scheme worked as it should, and they took metal out at the same rate as they put it in, the bath ought to remain substantially constant.

Oil-Fired Receivers Suggested

MR. J. J. SHEEHAN argued that if very high temperatures were not needed it hardly seemed necessary to have an electric furnace. The work described could be done in a receiver of either the oil-fired or gas-fired type. It would be instructive to know why Mr. Twigger abandoned receivers and adopted electric furnaces.

MR. TWIGGER explained that he had had some little experience with oil-fired receivers, in the shape of oil-fired crucibles, and had found it possible to maintain metal at the desired temperatures. Yet if it was a question of enabling composition to be modified in any substantial degree his experience was that they were not successful. If a substantial amount of cold metal was put into a crucible furnace it was a very considerable time before correct temperature was re-established. In the case of an oil-fired furnace, which although successfully used by some foundries as a melting unit, and which could also act as a receiver, the losses in holding any appreciable time were inevitably high, and it was difficult to maintain a steady and accurate composition. Mr. Twigger added that their experience over ten years or so, starting with a very small electric furnace and gradually installing larger units, had been in favour of electric furnaces. He did not think that oil-fired furnaces could have been applied so successfully as an electric furnace to the special cupola/electric duplexing method described in the Paper.

MR. A. G. ROBIETTE said Mr. Twigger and his colleagues were the first in this country to achieve duplexing on a small scale and on a continuous basis with specialised alloys. He thought that very great credit was due to them, for the scheme required careful synchronisation, and the castings required a high degree of control.

MR. F. C. PEARCE said it occurred to him that Mr. Twigger in his Paper had indicated the possible ultimate method of melting cast iron in this country; everywhere, that was to say, except in the light castings industry. That thought might come as a shock, perhaps, to some. When one looked forward and tried to assess what might happen in this country, if not in the immediate post-war years then later on, several things were apparent. In the first place, there was the limited supply of iron ore. Another consideration was economic stringency. Finally, he supposed that every foundryman thought of the day when foundries would not be up backyards but would be of considerable capacity. He visualised a cupola melting between 5 and 10 tons an hr. and the metal running into a 25-ton electric furnace which produced

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a material which was of high strength, from which machine tools and ordinary castings were made of very thin section, and another electric furnace for alloyed irons taking metal from the 25-ton electric furnace, and there seemed to him to be a great scheme for conservation of materials. Mr. Pearce added that from the practical point of view the electric furnace was far easier to handle than the oil-fired rotary furnace. Moreover, in wartime there would be less difficulty in getting new labour to operate the electric type of furnace than the oil-fired rotary furnace.

Choice of Furnace

MR. L. W. BOLTON said he understood Mr. Twigger to state that the rocking arc furnace was used mainly for melting from the cold special alloys or alloy irons for mixing with cupola metals, and that a three-phase furnace was used entirely for duplexing. He would like to hear why he chose three-phase furnaces rather than rocking arc for duplexing. He would also welcome some information as to the amount of cold material added to the duplexing furnace. Mr. Twigger had mentioned that he did not require a very high temperature, but he suggested that other types of furnaces would not be so efficient as the arc furnace because of taking into solution the cold metal added. Was the addition 5 per cent. of cold material, or higher quantities?

MR. TWIGGER, in replying, said it was quite true that larger sizes of rocking arc furnaces were made than those used in his own case. When they came to larger sizes, however, he thought the load factor would be very important in deciding them in favour of a three-phase furnace. Another reason was that in the rocking arc furnace they relied very largely on conduction from the furnace walls to heat up the charge. It would not be easy to arrange a rocking arc furnace for duplexing on the same lines as they had done, for the reason that full advantage could not be obtained from the rocking mechanism. His own impression was that in the larger sizes of furnaces they would almost certainly go to the three-phase furnace either for melting or duplexing. The three-phase furnaces lent themselves very well to pouring in molten metal in the way described, as well as adding solid material through the back door. That could not be done with a rocking arc furnace as at present designed. As to the amount of solid material added, it was usually about 5 to 10 per cent.

Replying to further questions, MR. TWIGGER said he did not imagine that the temperatures required for pouring most cast irons would exceed 1,450 deg. C. Obviously, it cost money to increase the temperature, but the increased current consumption for 1,450 deg. C. would not be great. The whole point of his Paper was that these electric furnaces were not used for something that could be readily done in a cupola. They continued to operate cupolas, and could not do without them, but he proposed to keep them on one base material for which there was a large demand and use the electric furnaces for adjusting the composition of materials, of which, perhaps, the tonnage was not so great—in total amount—but the material was of such importance that it must be very strictly controlled. It was very convenient, and he thought overall economical, to melt in a cupola and deal with the material in the manner suggested.

Oil-Fired Rotary Furnaces

MR. J. DOLPHIN maintained that oil-fired rotary furnaces had their place in industry. In his opinion the main difficulty with rotary furnaces was that they could not keep a bath of metal hot over a period without losing carbon and silicon. He had, however, worked these furnaces, melting any alloy desired and without very excessive losses and getting the same composition every day from the same mixture put into the furnace.

MR. TWIGGER said the furnaces referred to were to his knowledge in successful operation for melting, but he thought they could only be operated to the best advantage where it was possible to dispose immediately of the whole content of the furnace. They had to deal with a continuous unit which he thought placed these furnaces at a disadvantage.

The author was accorded a very hearty vote of thanks for his Paper, which was obviously much appreciated, containing as it does a wealth of actual working data.

Electrical Steel Furnace Refractories.—C. A. Brashares, in the "Transactions of the American Foundrymen's Association," deals with the resistance of silica bricks to slagging by FeO and CaO, a feature which makes this type of refractory well suited to electric furnace roof construction, on the basis of the $FeO\text{-}SiO_2$ and the $CaO\text{-}SiO_2$ equilibrium diagrams. The use of small roof bricks rather than large blocks is stated to decrease the spalling tendency. It is anticipated that increased use will be made of high alumina and magnesite refractories for electric furnace roofs. Aluminous fire-bricks give good service in the upper side walls, but are not suitable for use below the slag line. An interesting observation is that, in one instance, the use of limestone to form the first slag, and burned lime and sand for the finishing slag, led to disintegration of the magnesite walls and bottom when the furnace cooled; this was due to penetration of the $2CaO.SiO_2$ slag into the brickwork. The addition of calcium borate to the finishing slag is stated to overcome this trouble.

Black-out for American Steel Plants

A new booklet produced by the American Iron and Steel Institute describes the selection of personnel and organisation of A.R.P. staff, the establishment of zones, sectors and posts, outlines the duties of the air raid staff during an emergency, and gives other essential information and vital facts necessary to efficient steel plant protection under bombardment. The booklet is illustrated with detailed organisation charts.

E

A RAPID AND ECONOMICAL MOULD DRYING PROCESS

By K. E. WALKER

[This process was referred to by Mr. Frank Hudson when he opened a general discussion on "Fuel Conservation in Foundries," organised by the London Branch of the Institute of British Foundrymen, over which Mr. R. B. Templeton presided.]

The technique described here has been applied with success to small and medium sized gunmetal castings up to 3 cwts. in weight, and is also being applied to brass, manganese bronze, and phosphor bronze castings. It has been adopted to obtain increased output and economy in fuel consumption by eliminating the necessity for stoving moulds which previously were deemed to need thorough drying.

A normal flame drying process using a water suspension of a mould paint powder has only a limited application, and is rather laborious. The flame drying must be done very thoroughly to obtain consistent results, and there is always a tendency for the mould face to re-soften after drying due to moisture being absorbed from the backing sand. The paint layer is also prone to peel and crack due to unequal and excessive heating, and scabbing and swelling defects are quite common, especially when the flame drying is applied to moulds made from naturally bonded sand. Blowlamps or torch burners are required for the operation and the moulder wastes considerable time in attempting to dry the moulds.

Mixture Used

All of these disadvantages are overcome by using the mould dressing itself as the drying agent. Paint powder is suspended in an inflammable volatile liquid and bonded by incorporating in it an agent which is soluble in the suspending liquid, but not volatilised or destroyed by the heat of combustion when the mould is fired. Methylated spirit was found to be the most suitable suspending medium, and shellac has proved very satisfactory as a binding agent, being soluble in methylated spirit, and resistant to moisture. Experience has shown that about one part of thick shellac varnish in twenty parts of spirit is adequate to provide a strong hard face to a mould without causing any dangerous evolution of gas.

A proprietary paint powder containing chiefly silica flour, plumbago and colloidal clay is mixed with the spirit solution of the shellac in the proportion of 2 lbs. of the powder to a quart of the spirit. It has been found also, that a further clay addition of about one quarter of a pound of colloidal clay to the above quantities has a strengthening influence on the paint layer. The addition is made to allow for the fact that only part of the dry strength of the paint powder itself is developed when it is not mixed with water, and the extra clay seems to increase the strength obtained from combination with surface moisture on the mould face. A suitable mixture of silica flour, plumbago, dextrine and about twice the clay normally allowed for a mould dressing should provide a satisfactory base for the mixture, if it is preferred to mix all the materials rather than use a proprietary paint powder.

Method of Application

It is important that the paint mixture should be well stirred during use, since the methylated spirit will not form a colloidal suspension and emulsion with the paint powder, as in the case of a water mixture. Moulds can be either brushed or sprayed with the paint mixture; brushing, however, is preferable when it is practicable since it is very much more economical. The brushing itself is easily performed as no dragging of the mould surface is experienced, even when moulds are brushed vigorously. Penetration of the wash into the sand surface is more marked than in the case of a water suspended wash due to the lower specific gravity and surface tension of the methylated spirit and the absence of any emulsifying action with the clay in the mould. On no account should the spirit wash be applied to an oil sand core, because spirit attacks and dissolves away the oil binder, and the surface of the core crumbles. Any spraying should be done, therefore, before inserting cores.

When a mould has been painted it is immediately ignited. The methylated spirit burns away and the heat of combustion dries out the surface moisture, and hardens the paint layer. A thin tenacious film of shellac remains to form with the other paint materials a tough and elastic skin which cannot be blown away or broken unless considerable pressure is applied. This surface does not soften if the mould is allowed to stand, and never cracks even when the mould is roughly handled, owing to the deep penetration of the wash. Very few moulds require any further drying since the combustion of the methylated spirit develops a high surface temperature. Occasionally, however, deep moulds require extra drying with a blowpipe but only a very brief application of the flame is necessary to ignite and dry any damp patches. It is important to ensure that all the spirit is ignited and volatilised to avoid the formation of gas during casting.

Sand Control and Cost of Process

This process is particularly suitable for use with synthetic sand. The lower moisture content of synthetic sand is less of a deterrent to the burning of the spirit, and the more open mould surface permits greater paint penetration, and consequently a stronger film is formed. In view of this fact, it has been found beneficial to adopt a very open synthetic sand for all non-ferrous castings, and to mould on a moisture of between 3.5 to 4.2 per cent. Moulds made from such a sand can be safely rammed very hard without risk of scabbing and there is no tendency for roughness or metal penetration even in the case of phosphor bronze castings. Although the technique has not so far been applied to castings heavier than 3 cwts. in weight, there seems no reason why it should not be successful, providing that moulds are rammed hard. The finish obtained on castings has proved to be superior to that experienced with moulds

(*Continued on page* 36.)

BRITISH CAST IRON RESEARCH ASSOCIATION

REPORT OF ANNUAL GENERAL MEETING

The Annual General Meeting of the British Cast Iron Research Association, held at the Queen's Hotel, Birmingham, on December 16, was preceded by a luncheon of the Council, which served as the occasion for Mr. P. Pritchard (President) to express his views on research and post-war prospects. Other speakers were Dr. Harold Hartley (chairman of the Council) and Mr. A. L. Hetherington, C.B.E., Assistant Secretary to the Department of Scientific and Industrial Research.

DR. HAROLD HARTLEY, at the Council luncheon, referred to the acquisition of a new home for the Association, the transfer to which he said had been accomplished satisfactorily, and expressed their indebtedness to Mr. F. J. Cook, M.I.Mech.E., for undertaking much of the detail work. A great many members had responded to the appeal for increased subscriptions. He thought they might feel proud of the list published in the Annual Report.* That so much support had been received gave them a feeling of confidence, not only in the prospects of the Association itself, but in the future of cast iron, in which they were all interested. They were determined to equip the laboratories in such a manner that the Association would be able to render all the help expected by subscribing members and to enable it to play a foremost part in cast-iron research. Towards the original target of £15,000, £10,000 had been promised, which took them well on the way, and they were hopeful of passing the first target figure. They owed much to the enthusiasm of Mr. Arnold Pearce and Mr. J. G. Pearce. They were proud of their new home and he hoped everyone would agree that the move had been fully justified.

Dr. Hartley spoke of the great indebtedness of the Association to the President who, he said, had given them encouragement and help from the inception of the removal scheme. They thanked him heartily for his assistance. There was to be an opening ceremony in the spring. They hoped that all members of the Council would be able to be present and that there would be a good attendance of members.

Research and Reconstruction

The PRESIDENT (Mr. P. Pritchard) thanked Dr. Hartley for his remarks and said that, if he were entitled to any reward for anything he had been able to do, it was provided by the knowledge that the Association and the ironfounding industry as a whole might benefit in the future. At the present time, he continued, the question of post-war reconstruction was being actively discussed. Industry was the main source of this country's wealth and seemed likely to be asked to make increased provision for social services. With the prospect of having to face greatly diminished revenue from overseas investments and services, it was obvious that exceptional steps must be taken if this country was to maintain a high standard of living for its people. During this war, as in the last, many of the lesser-developed countries had been compelled to make themselves industrially self-sufficing, at any rate with respect to the more elementary products, while others had carried their pre-war industrial development a stage further. In other words, we could not expect to re-enter many of the markets for primary products which were previously open to us. We must, therefore, direct our energies to seeking, or even creating, fresh markets. The creation of primary industries in our former markets should, and usually did, create a demand for other goods of greater complexity and of a different character, made necessary by those new activities.

He suggested that we must equip ourselves in order to be able to supply such requirements. As the pupils of pre-war days had now caught up with us, our industries must lift themselves to higher planes, largely by the conduct of scientific research and the use of the intelligence of our people, aided by training and education. All these factors, added to the materials we could employ and with which this country was fairly liberally endowed, should enable us to create markets for new types of products for which there should be ready buyers. Taken in the aggregate, the ironfounding industry was a great industry. It was perhaps about one-fifth the size of the steel industry in respect of labour employed and output, but its great weakness lay in the difficulty ironfounders had in appreciating that they must act together.

A Large-Scale Industry

The diversity of applications of cast iron was perhaps responsible, but in the technique of founding, which was quite different from that employed in other industries, surely all foundries could meet on common ground. The aggregate capital and labour employed, and the value of the output of the ironfounding industry, was much higher than was commonly supposed, and founding must certainly rank as one of the major industries of the country. The industry had no reason whatever to be ashamed of the provision it had made for research during the past ten or fifteen years, but it should recognise that, taken as a whole, it had not made anything like the provision that had been made available to, say, the steel, electrical, non-ferrous, textile, coal and other industries. In this connection, he might mention that one industry with which he happened to be associated had recently formed a new association for research and development and the first six firms invited to subscribe had guaranteed annual subscriptions amounting to £15,000. As he indicated a year ago, he was a firm believer in the future of cast products in general, and cast iron in particular, but he qualified this to-day by the statement that only by constant and intensive research and development work would cast iron maintain its position in the realm of cast metals against the encroachment of newer materials.

He was confident that the Association would contribute in no small measure to this end, and he believed that the new premises formed a nucleus of which it could be proud and from which any developments

* See our issue of December 24, 1942.

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required by the industry could be made. He would like to suggest that the post-war position of the research associations should be seriously considered by the Government. Any plans evolved would be foredoomed to failure, however, unless industry was not only convinced of the importance and value of the work, but was determined to make full use of the results achieved.

Industrial Development and Research

Entering a plea for the creation of some new machinery which could take over the results of research and foster their practical application, the President said a bridge was required to facilitate the transfer of the work of research associations across the gap which separated them from production practice. The immediate post-war demand for goods and political factors might be such as to eliminate competition between producers in the ordinary and commercial sense, but he was sure that they would ultimately see a battle between alternative materials, each striving to achieve precedence in a particular field of use. The issue in each case might not be decided on grounds of cost alone, but by such factors as technical excellence, ease of fabrication, appearance and public fancy.

The implication of all this was that not only must each industry be "on its toes," but that it should keep prominently in mind that, in respect of research and development, to stand still was to slip backwards. While it was not too much to hope that in a post-war world many of the past misfortunes of industry occasioned through political and economic causes beyond its control might be averted, he was persuaded that the maintenance of a high standard of living for this country would depend on its ability to purchase imported food and raw materials which, in turn, must be paid for by what we could export.

Great Britain had been curiously behind other countries in the export of ideas, processes and special equipment; indeed, it had usually been the Mecca of all those nations which had such wares to sell. He had the feeling that in some measure this was due to a noticeable reluctance on the part of this country to embark on research work or industrial pioneering where immediate and tangible returns were not particularly in evidence. If, therefore, to our reputation for excellence of quality we could add up-to-date designs, plus technical superiority of process or product, he was certain that we could retain our position in the export market without sacrificing our English ideal of standard of life. So far as ironfounding was concerned, the Association had a great part to play in achieving this result, not only in relation to export production, but in helping industry as a whole to do its part in the same direction.

Coal Research Endowed

MR. A. L. HETHERINGTON congratulated the Association, in common with the other great research associations of the country, on the fine work that had been done in support of the war effort. He assured his hearers that the Government, and the Department of Scientific and Industrial Research, were wholehearted believers in research associations. One thing that had been brought out in the crisis was the way in which all the research associations had worked in the national interest and had been oblivious to a large extent of the fact that certain firms needing help were not members. The Association had done a great work not only for their members, who were their first charge, but also in the national interest. As a result many firms had taken much more notice of the research associations than in the past. New members had been secured, and he was confident that in the post-war period not only would those members be retained, but that others would be added.

The President had spoken of the natural resources of this country. Countries like Germany and Switzerland, lacking some of those endowments, had encouraged more intensive scientific research in order to compensate for their deficiencies. That was perhaps one of the reasons why Germany had gone ahead on the scientific side. When the war came to an end, however, were we quite sure that this country would continue to enjoy its former privileged position? For himself, he was doubtful. That was an added reason why intensive scientific investigation and research would be needed to secure the quality of product which was an all-important matter when export trade was in question. The President had also touched on the new social order as foreshadowed by the Beveridge Report. The Report, as he (Mr. Hetherington) understood it, presupposed that there should be full employment in this country. That was a further reason why we must see that scientific processes were developed and that new products were produced. Reference had also been made to the gap between laboratory results and the practical application of those results—a very real point. If the gap was to be bridged, it meant that the activities of the research associations must be expanded in order to embrace that secondary stage as well as the initial test-tube stage. The coal industry had recently enlarged its activities to an enormous extent and had a potential income for research of £200,000 a year. He hoped that the ironfounding industry would enable the Cast Iron Research Association to face up to its responsibilities and potentialities.

A meeting of the Council followed the luncheon.

ANNUAL GENERAL MEETING

The day's proceedings ended with the Annual General Meeting. There were a number of apologies for absence, including one from Sir Lawrence Bragg. The Report and Accounts were presented and adopted without comment.

In proposing the re-election of Mr. P. Pritchard, M.I.A.E., as President of the Association, DR. HAROLD HARTLEY said he wanted to record their very warm appreciation of the help that Mr. Pritchard had given the Association, and of the interest he continued to take in it. He mentioned that the President had put forward four very important suggestions for considera-

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tion by the Research Committee. They were very fortunate in having Mr. Pritchard as President.

DR. J. E. HURST, who seconded the proposition, said he thought Mr. Pritchard was the first practical foundryman to become President of the Association. By the suggestions that he had put forward Mr. Pritchard had shown what he could do during his first year of office. He was now entering on his second year. They did not know what he would do, but they were confident that it would be something really good.

MR. P. A. ABERNETHY, speaking in support of the motion, said that unfortunately he had not attended many meetings during the war period. From the reports issued and the minutes of the various meetings he had observed, however, the very great assistance that the President had been to the Association in many ways. The Council and membership owed Mr. Pritchard a debt which it would be very difficult to repay.

The proposition was heartily endorsed by the meeting.

The President's Reply

Acknowledging his re-election, the PRESIDENT expressed his deep appreciation of the honour paid him in appointing him President for a second year. He greatly valued that token of confidence, he said, not only because of its outward significance but because he felt that, knowing the industry and understanding some of the difficulties which might face both the industry and the Association in the near future, it might be possible—he hoped it would be—for him to continue to be of service.

Professing his belief that they would ultimately see in industry a battle of materials—the old established materials against the newcomers—he said the process had, of course, already begun. He was acquainted with numerous instances where, for example, cast iron had replaced steel. On the other hand, steel was now attempting to invade the field held by cast iron in the manufacture of welded and built-up structures. He could also see the possibility of cast iron losing ground to plastics and light alloys. All this in his opinion made it more than ever necessary that the cast iron industry should seriously devote its energies to the acquisition of new fields of production.

Those new fields might perhaps be divided into two classes. One would be in the direction of cheapening and widening the scope of the more commercial applications of cast iron, such as was indicated by the light-castings branch. The other side of the picture was concerned with the improvement of the qualities of cast iron to render it suitable for more arduous duties and for applications not hitherto envisaged.

Cast-Iron Boilers Decried

In this connection he mentioned that he was recommended both by the architect and builder not to put in cast-iron boilers for the ranges in some cottages, but to substitute copper. It struck him as rather a reflection on the cast iron industry that, irrespective of price, he should be persuaded to put in an alternative material instead of one which he supposed had been used ever since boilers were. As he had indicated, the deciding factor was not price but technical excellence. He did feel that as an industry they must set themselves the task of providing new fields and new outlets for their products. They must not think on niggardly lines in the matter of research. Research cost money and the return was not always adequate. He thought, however, that it was safe to say that on balance with properly applied research the money invested was returned many times over.

The President then emphasised the necessity for the better application of the results of research. He had found in his own practical experience, he said, that the work of research organisations was frequently wasted because of the lack of means to translate academic findings into the practical politics of the foundry. He put it to the Association and to the industry as a whole that the industry would benefit immensely from the money it was spending on research if some additional machinery could be devised to fill the gap between production and research.

The Shortage of Technicians

In the foundry industry, he continued, the standard of technical knowledge of the average executive was deplorably low. There was a real dearth of good foundry technicians. He would like to put it to Dr. Hartley and to the Council of the Association that, while he knew it was not particularly within the orbit of their duties, they would help the ironfounding industry and indeed the whole foundry industry of the country to an enormous extent if they could institute some means for the better training of foundry technicians. After all, there were sufficient rewards in prospect in the foundry industry to tempt the right men, and if only the avenues of training were provided the industry would ultimately benefit. In this connection he offered the suggestion that the Association might consider the interchange of personnel between member firms and the laboratory staff of the Association. If this could be done it would open up at least one avenue for improving the technical excellence of foundry technicians. (Hear, hear.) He found it exceedingly difficult to measure the technical capabilities of applicants for executive posts and he thought there was room for a special Degree in Foundry Engineering. They might call it a Degree of Metallurgical Engineering. It would indicate the type of man for whom they were really seeking in the foundry industry to-day—that was to say, an engineer who had metallurgical and foundry knowledge. Such men, from his own personal experience, were the hardest type of executive to find.

The Foundry School

DR. HARTLEY promised that the President's suggestion with regard to an interchange between firms' technical personnel and the laboratory staff of the Association should have careful consideration. At

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the request of Dr. Hartley, MR. J. G. PEARCE (Director) gave a brief account of the work undertaken by the British Foundry School in the years prior to the war, whereby young men already employed in the industry, who had convinced their employers that they were the right kind of raw material for development, attended for a full-time intensive course leading to a diploma which was a kind of professional certificate for the industry. About forty men were so trained. During the war it was not thought right to maintain courses when executives were needed on the foundry floor. He mentioned, in passing, that the Association had always carried on auxiliary courses for young men from member firms who wished to pursue their training in any direction in which the Association could assist. The reverse process had not been possible, because it was difficult to spare members of the laboratory staff, and a number of them had already had considerable practical experience. In the case, however, of a number of apprentices who came from the secondary schools at the age of 17 or thereabouts for a four years' laboratory course, he had in recent years adopted the practice of giving them, by arrangement with members, some practical experience in members' works. They had also endeavoured to run what were called study courses, members being invited to send representatives to meetings held in Birmingham and Glasgow, and which were attended by as many as 150.

The PRESIDENT thanked Mr. Pearce for his outline of what had been done in the directions he (the President) had indicated, and explained that he had in mind not only the training of young technicians from the works by the Association, but an opportunity being provided for a particular problem with which an individual member was confronted being investigated by one of the works technicians in the Association laboratory side by side with the Association's staff.

The following were re-elected Vice-Presidents of the Association:—Mr. J. F. Davies, Mr. J. E. V. Jobson, Mr. W. B. Lake, Dr. T. Swinden, Mr. P. H. Wilson, and Mr. FitzHerbert Wright.

The following were re-elected to the Council:—Mr. J. Arnott, Mr. A. J. Burn, Dr. W. T. Griffiths, Mr. T. M. Herbert, Mr. A. Hodgkinson, Mr. W. B. Parker, Mr. S. H. Russell, Mr. H. H. Shepherd, Mr. G. A. Ure, Mr. G. R. Webster, and Mr. H. B. Weeks.

Messrs. Poppleton and Appleby were reappointed auditors for the ensuing year.

Tendering the thanks of the meeting to the Council for their services during the past year, the PRESIDENT said he knew a little of the arduous nature of the work voluntarily undertaken by members of the Council on behalf of the Association. Dr. A. B. Everest seconded the motion, which was carried.

The PRESIDENT also thanked the members of the Committees and Sub-Committees for their work, and

(*Continued at foot of next column.*)

BENEFICIATION OF MINETTE AND BLAST-FURNACE DUST

The advantages to smelting accruing from a preliminary grinding and sintering of iron ore, as indicated by a survey of the various methods for beneficiation of minette and blast-furnace dust by the ARBED concern, are analysed by J. PAQUET and M. STEFFES in Report No. 208 of the blast-furnace committee of the Verein deutscher Eisenhüttenleute, reprinted in "Stahl und Eisen" of July 23 last. By suitable preparation of the ore and dust before being charged to the blast furnace, a considerable saving in smelting costs is possible which, it is claimed, exceeds the extra expense of beneficiation. The choice of a sintering plant must, however, be given due consideration if economic results are to be obtained. The authors have carried out a series of sintering experiments to elucidate the optimum conditions of preparation, using blast-furnace dust and ore fines in a Smidth-type rotary furnace, and to derive the effect of the composition of the burden and preheating of the air on the fuel consumption and rate of throughput. Heat balances are shown to be useful for obtaining a closer insight into the many reactions taking place in the furnace.

The ARBED concern, realising that ore beneficiation is becoming increasingly important in smelting practice, have for years followed a systematic plan by which the whole of the minette to be smelted is first reduced in size and classified and the resulting ore fines then sintered together with the blast-furnace dust. Considerable research has demonstrated that crushing of the ore followed by sintering mixtures of ground ore and blast-furnace dust reduces the coke consumption by 150 kg. per ton of pig-iron. For years the rotary sintering furnace was regarded askance in the industry, but it has now been shown that it gives results comparable to those obtainable with other beneficiating methods, suggest the authors.

In the discussion which followed the presentation of this report in March last, various economies in fuel consumption were claimed from the beneficiation of minette and similar ore prior to smelting, but only of the order of about a fifth of the amount stated by the authors. The discussion throws an interesting light on the considerable amount of work which has been done in Germany on ore beneficiation, mainly to achieve a saving in coke consumption.

SAVE AND SALVAGE ALL PAPER

(*Concluded from previous column.*)

paid a warm tribute to the Director and Secretary, Mr. J. G. Pearce, and staff. MR. G. N. GUEST seconded the proposition, and it was approved.

On the motion of DR. HARTLEY, seconded by MR. W. TODD, the President was thanked for his services in the chair.

ECONOMY IN THE USE OF FERRO-ALLOYS

By Dr. W. H. HATFIELD, F.R.S.

At the recent British Association Conference on Mineral Resources and the Atlantic Charter, DR. W. H. HATFIELD, F.R.S., read a Paper on "Economy in the Use of Ferro-Alloys," in which he gave a brief review of the number and distribution of the alloying elements used in ferrous metallurgy, and their relation to the principal steelmaking countries and techniques. Pointing out that 25 elements were of direct interest in the production of steel, as scheduled in Table I, Dr. Hatfield suggested that these could be divided substantially into four groups, *i.e.*, (i) the dominant alloying elements, (ii) the secondary alloying elements, (iii) those appertaining and arising essentially as regards process, and (iv) those used for protective coating.

Of the dominant alloying elements, *i.e.*, manganese, chromium, nickel, molybdenum, tungsten, cobalt and vanadium, it is of great interest to note that four of these elements were originally isolated in Scandinavia, one in France, one in Germany and one in Spain, whilst of the secondary alloying elements, aluminium, titanium, zirconium, niobium, selenium and copper, three were isolated in Scandinavia, one in France, and one in Britain, whilst the last mentioned, copper, was employed in prehistoric times. With regard to the elements iron, carbon, and silicon, these are so fundamental as almost to escape notice, but whilst iron and carbon date from prehistoric times, silicon was only isolated in 1854 in France. Hydrogen, nitrogen, phosphorus, arsenic, oxygen, sulphur are to be looked upon as essentially impurities arising from the process, whilst zinc and tin are used for coating steel in protection against rust (as of course in smaller degree are cadmium and nickel).

In an effort to be able to present a complete picture the author sought to: (*a*) Schedule the production of the relevant raw materials as regards country of origin; (*b*) schedule the countries where the raw materials were smelted or reduced to a usable form; (*c*) schedule the origin of the relevant raw materials used by the different steelmaking countries. Such statistical evidence merits careful study, and although not sufficiently available for a complete statement, does point to facts of great interest.

The volume of production of an ore in a country is indicative of the achievement of economical winning, but not necessarily of the resources prevailing. There may be great quantities of low grade ore, railways may not be available, and population of a suitable character may not be there. Distance too is determining from the economic point of view; for instance, a great country may find it advantageous to obtain material from a neighbouring country rather than from within the confines of its own extended territory. The geologist locates, the mining engineer advises on practicability, and the industrialist backed by adequate finance seeks to develop these relevant deposits. Sound knowledge, enterprise and no little courage are demanded. The collective outcome normally is availability in reasonable relationship to world demand.

Steelmaking Countries Lack Full Resources

Without exception, the steelmaking countries do not possess complete essential resources and must import much that is necessary. In normal times, international trade provides the necessary facilities at world prices on a reasonably economic basis. Small countries as well as large ones have successfully developed important steel industries.

Concerning the principal alloying elements used in the alloy steel industry, manganese ore, whilst widely distributed, is produced essentially in Russia, India, West and South Africa, Brazil and Germany. Nickel ore production is focussed essentially on localised deposits in Canada. Chrome ore, whilst very widely distributed, is produced in Rhodesia and South Africa, Turkey and U.S.S.R., and in lesser degree in Cuba, the Philippines, India, Yugoslavia and Greece. Tungsten ore is essentially produced in China, Burma, and in less degree in the U.S.A. and South America. Molybdenum ore production is focussed essentially on deposits in the United States of America. Vanadium ore is produced essentially in Rhodesia and South-West Africa, U.S.A. and Peru. Cobalt ore is derived principally from the Belgian Congo, Rhodesia, French Morocco, Canada and Burma.

It will be thus seen that the principal steel-producing countries—U.S.A., U.S.S.R., Germany, Great Britain, France, Japan, Belgium, Luxemburg and Scandinavia—

TABLE I.—*List of the Elements of Interest in Steel Metallurgy.*

Element.	Group.	Date. Isolated.	Metal isolated by.
Hydrogen ...	I	1766	Cavendish.[1]
Copper	I	Prehistoric	—
Zinc	II	Prehistoric	—
Aluminium ...	III	1854	H. St. C. Deville.[2]
Carbon	IV	Prehistoric	—
Silicon	IV	1854	H. St. C. Deville.[2]
Titanium ...	IV	1825	Berzelius.
Zirconium ...	IV	1824	Berzelius.[3]
Tin	IV	Prehistoric	—
Lead	IV	Prehistoric	—
Nitrogen	V	1772	D. Rutherford.[1]
Phosphorus ...	V	1669	H. Brand.[4]
Vanadium ...	V	1830	Sefstrom.[5]
Arsenic	V	1240	Albertus Magnus, Bishop of Regensburg.
Niobium	V	1801	Hatchett.[1]
Oxygen	VI	1774	Priestley.[1]
Sulphur	VI	Prehistoric	—
Chromium ...	VI	1798	Vauquelin.[2]
Selenium ...	VI	1818	Berzelius.[5]
Molybdenum ...	VI	1782	P. J. Hjelm.[5]
Tungsten ...	VI	1783	F. D. and H. J. D'Elhuyar.[6]
Manganese ...	VII	1774	J. G. Gahn.[4]
Iron	VIII	Prehistoric	—
Cobalt	VIII	1742	Georg Brandt.[5]
Nickel	VIII	1751	Cronsted.[5]

[1] British [2] French. [3] Swedish. [4] German. [5] Spanish.

Economy in Ferro-Alloys

are dependent upon the normal functioning of international trade and copious transport, particularly in the form of shipping.

Great Britain relies upon importing 30 per cent. of her iron ore and the whole of her manganese, chrome, nickel, tungsten, molybdenum, vanadium and cobalt. Germany relies upon importing most of her manganese ore and the whole of her chrome, nickel, tungsten and molybdenum; she claims to recover her vanadium at home. The U.S.A. imports over 90 per cent. of her manganese ore and practically the whole of chromium, nickel, cobalt and a substantial proportion of her requirements in tungsten. It is thus obvious that the conditions postulated in the fourth clause of the Atlantic Charter did operate even in the period between the two great wars, or how can one explain for instance the successful iron and steel industries of Scandinavia and Belgium-Luxemburg.

Diverse Properties Conferred by Alloying Elements

One of the greatest technical achievements is the colossal output of iron, and by virtue of the influence which carbon and other elements can confer readily upon it, a very wide range of properties are available. Steel may be soft and ductile, hard and of great strength, wear resisting, rust and acid resisting, heat resisting; may be of high permeability, capable of a high degree of permanent magnetism, may be non-magnetic, have a high electrical resistance, or a low coefficient of expansion. It may possess various combinations of these and other properties as required. It can be converted by added elements into any of a wide range of tool steels and steels for many special applications. These results are attained by a knowledgeable heat-treatment superimposed upon a selected suitable composition.

Some 15 elements are involved in the production of these various properties, and it will at once be apparent that millions of alloys of various compositions would need to be tested out really to put this phase of metallurgy upon a finally quantitative basis. Thus some properties may be achieved by using different proportions of different elements, and that fact, coupled with other factors operating in the world, has resulted in quite a complexity as regards the number of steels available. The obvious thing is for the producer and user in co-operation only to use those compositions which are most effective and most in sympathy with the availability of the materials.

The problems before such a collaboration are influenced by many variables. There is the peculiar combination of properties required for a particular purpose, achieved by complex compositions which although in practice they achieve their purpose, have been found to do so by practical trial; that is, by "trial and error" method; and it is not always easy in a steel containing a number of alloyed elements in different proportions to diagnose the extent to which amounts of each individual element contributes or to what extent the selected superimposed heat-treatment is responsible for the ultimate result. Again, it can be argued that so long as the necessary mechanical and physical properties are secured, the composition and treatment are of secondary importance; this might truly be argued, were it possible, by testing methods alone to ascertain definitely whether the conditions for a particular service have been achieved. Laboratory tests to simulate the calls of service are valuable, but they are generally incomplete. Even the designer, try as he may, is never sure of being able to postulate completely on paper the conditions which he has to meet and then provide the means of meeting them.

Thus, by practical experimental procedure based on existing knowledge, mechanisms and apparatus are provided, built of materials which by trial are found to serve the purpose. It is, therefore, not a matter of surprise that when success has been painfully achieved by modifications here and there as dictated by circumstance, the means whereby success has been achieved, are fairly rigidly adhered to. When stock is taken in a national emergency, multiplicity of types of material and of design is to be expected. The next step is to facilitate mass production by strictly limiting the number of designs and vastly reducing the number of types of material.

Dr. Hatfield then proceeded to examine what had been done in this country to rationalise special steels with a view to conserving alloys. This matter formed the subject of another Paper which Dr. Hatfield recently gave to the Sheffield Metallurgical Association.

RAPID AND ECONOMICAL MOULD DRYING PROCESS

(*Concluded from page* 30.)

blacked and stoved in the normal manner. No scabbing has occurred, and no troubles due to unsoundness or porosity have been encountered. Many castings have been pressure tested, sectioned and X-rayed with satisfactory results in all cases.

It has been found that two gallons of methylated spirit are sufficient to treat a normal stove load of moulds, the stoving of which would consume 6 cwts. of coke. Apart from the economy in actual quantity of fuel consumed, the cost of the spirit required is less than one-third of the cost of the coke. Furthermore, consumption could, no doubt, be reduced if all moulds were brushed in place of spraying.

Output is much increased since moulds treated in this way can be cast almost as rapidly as normal green sand moulds, and all the extra labour necessitated for the production of dry sand castings is eliminated. Further substantial gains are that moulding boxes can be knocked out more rapidly and are more frequently available for re-use. Providing that supplies of industrial methylated spirit are available, this process may be capable of considerable development. There seems to be no reason why wood spirit (methyl alcohol) should not be employed, although it is questionable whether its use for spraying would be advisable on account of its rather poisonous nature.

NEW YEAR HONOURS

Additional names of people in the heavy industries, who have received awards in the recent New Year's Honours List, are given below. The first list appeared in our last week's issue.

ORDER OF THE BRITISH EMPIRE

O.B.E. (Civil Division)

MR. T. GAMMON, superintendent, Vickers-Armstrong, Limited; MR. J. R. GEBBIE, managing director, William Doxford & Sons, Limited; MR. G. E. G. GILFILLAN, superintendent, forge and engineering departments, English Steel Corporation, Limited; MR. T. MEEHAN, Divisional Officer, Middlesbrough, Iron and Steel Trades Confederation; MR. B. B. MURDOCH, Assistant Director of Materials Production, Ministry of Aircraft Production; MR. F. A. SMITH, general secretary, Amalgamated Engineering Union; MR. P. H. WILSON, assistant managing director (technical), Stanton Iron Works Company, Limited.

M.B.E.

MR. F. J. BATES, works director, Birmingham Small Arms Tools, Limited; MR. J. BLACK, chief of technical staff, North British Locomotive Company; MR. H. F. BONNER, chief planning engineer, John Thornycroft & Company, Limited; MR. S. G. BUTLER, managing director, Butro Jig & Engineering Company; MR. A. CHARLES, managing director, Smith Meters, Limited; MR. T. H. W. CRUDDAS, works manager, L.N.E. Railway Company; MR. H. I. F. EVERNDEN, designer, Rolls Royce, Limited; MR. H. W. FORSTER, steelfoundry manager, W. Shaw & Company, Limited; MR. W. HARTLAND, light alloy forge inspection superintendent, Smethwick Drop Forgings, Limited; MR. E. W. LAWRENCE, works manager, Stothert & Pitt, Limited; MR. A. MACHAN, manager, tool works, Capital Steel Works; MR. J. W. S. MUSTART, works manager, North Eastern Marine Engineering Company (1938), Limited; MR. A. PARKINSON, joint managing director, Crompton, Parkinson, Limited; MR. H. G. SAYERS, assistant superintendent, L.N.E. Railway Company, Edinburgh; MR. H. SHAND, director, G. A. Harvey & Company, Limited; MR. F. R. SMITH, works superintendent, Armstrong Whitworth, Limited; MR. J. B. SMITH, works manager and technical adviser, Brockhouse group of companies; MR. J. B. SMITHSON, chief draughtsman, engine works department, Smith's Dock Company; MR. B. SYKES, senior scientific officer, Ministry of Aircraft Production; MR. E. I. TALBOT, superintendent, A. V. Roe & Company, Limited; MR. D. H. TITCHMARSH, assistant to chief engineer, Magnesium Elektron, Limited; MR. J. U. VASS, works manager, Consolidated Pneumatic Tool Company.

BRITISH EMPIRE MEDAL

MR. P. W. E. ALLEN, foreman in charge of metal stores, Birmingham Aluminium Casting Company, Limited; MR. R. BARTON, chief works radiologist, Aeroplane & Motor Aluminium Castings; MR. W. C. BOLINGBROKE, chief Diesel tester and senior foreman, Davey, Paxman & Company, Limited; MR. R. L. BREADNER, technical assistant, research laboratories, General Electric Company, Limited; MR. L. BROWN, installation shift foreman, International Alloys, Limited; MR. J. BUCHANAN, deputy foreman, Magnesium Metal & Alloys, Limited; MR. G. CATTERALL, patternmaker, Leyland Motors, Limited; MR. E. F. GINGELL, patternmaker, J. & E. Hall, Limited; MR. J. R. HODGSON, shop manager, Clarke, Chapman & Company, Limited; MR. G. H. LANGRIDGE, foreman of Admiralty Signal Establishment Department, Allen West & Company, Limited; MR. H. LOVE, works superintendent, District Engineer's Office, L.N.E. Railway Company; MR. W. MCLEOD, head foreman engineer, Barclay, Curle & Company, Limited; MR. A. E. OATES, head iron foreman, S. P. Austin & Sons, Limited; MR. W. OGILVIE, chief inspector, G. & J. Weir, Limited; MR. S. E. POTTAGE, machine shop foreman, Cooke, Troughton & Simms, Limited; MR. F. PRATT, foreman, Armstrong Whitworth, Limited; MR. R. RAMSAY, head foreman, machine shop (engineering works), John Brown & Company, Limited; MR. Z. SMITH, senior production engineer, Craven Bros. (Manchester), Limited; MR. H. SWAINE, tool-room foreman, Hepworth & Grandage, Limited; MR. C. W. TAYLOR, coremaker, British Thomson-Houston Company, Limited.

PUBLICATION RECEIVED

Post-War Planning and Reconstruction. Issued by The Institution of Municipal and County Engineers, 84, Ecclestone Square, London, S.W.1. Price 1s. post free.

Most pamphlets written around this subject emanate from bodies and persons with a political axe to grind, but this one keeps the subject within a perspective which will be appreciated by technicians. This is because it is virtually a Committee Report endorsed by the whole of the membership from a professional institution. It is comprehensive, without being detailed, which makes it an admirable document to place in the hands of the authority ultimately to be responsible. The general attitude is that a central body should "plan" in the widest sense of the word, and then the district authorities should undertake the detailed planning and execution. The legislative aspect is as clearly set out as are the actual creation of highways and small townships. The reviewer would hesitate before endorsing the notion of a standardised system of road lighting, as being a brake on the urge to research, which was such a commendable feature of the illuminating engineering industry in the immediate pre-war years.

Republic Steel Corporation is to build a plant at Youngstown, O., for the production of sponge iron. The new plant will have a capacity of 100 tons of sponge iron per day, which will be used as a substitute for scrap in the output of steel. It is estimated that the plant will cost about $450,000, and the sponge iron will be made from low-grade New York State ore.

NICKEL AND THE WAR

Mr. R. C. Stanley, chairman of The International Nickel Company of Canada, Limited, announces that the company's 35-million-dollar expansion programme has reached a point where it now assures an increase in annual productive capacity of 25,000 short tons of nickel over that of 1940. Even this marked increase is not sufficient of itself to satisfy the ever-growing war needs of the United Nations, and must be supplemented by conservation, to ensure the most economical use of this vital war material, and by the fullest possible recovery of nickel-bearing scrap, a practice in which there is still considerable room for development. In both these supplementary contributions to the war effort, the company is taking an active share; its technical staffs on both sides of the Atlantic are aiding the nickel-consuming industries to reduce their requirements whenever practicable, advising on the most economical use of nickel, and offering technical assistance in connection with the utilisation of scrap. Such measures have already played an important part in lessening the demands on primary production and, in conjunction with the vastly increased output from the company's mines and refineries, should prove adequate for the essential needs of all the Allies.

INDUSTRIAL HEALTH

Inserted in the October copy of the "Industrial Accident Prevention Bulletin" were a series of quite sensible small pamphlets dealing with matters of personal health, and, apparently for their advertisement, a few ridiculous leaflets. These have been issued by the Central Council for Health Education. The compiler of the leaflets has followed the detestable methods used in the patent medicine fraternity. Surely there are sufficient neurotics in the country without adding to their number by auto-suggestion. There is every reason to believe that absenteeism will increase if these advertising leaflets have wide circulation and nothing short of their immediate withdrawal is called for.

CATALOGUE RECEIVED

Dust Fans.—Davidson & Company, Limited, Sirocco Engineering Works, Belfast, have just issued Publication S.F.203, which presents by illustration, letterpress and tabular matter a mass of technical data covering a wide range of dust extracting fans. Actually, two main types, both divided into full and narrow width models, are available in about a dozen sizes. Thus, fans measuring from a few inches in diameter to over seven feet have found industrial application. Foundrymen familiar with the operation of these dust extracting fans in their patternshops and elsewhere will be interested in reading of the latest developments amplified by reliable and extensive performance data.

OBITUARY

LIEUTENANT A. JOHN W. MATTHEWS, R.E., has been killed on active service, aged 24. He was the only son of Sir Ronald W. Matthews, chairman of the Brush Electrical Engineering Company, Limited, and managing director of Turton Bros. & Matthews, Limited, Sheffield.

MR. CHARLES F. BARKER has died at Coventry at the age of 78. Mr. Barker was apprenticed in a Government foundry in London and in 1890 went to South Africa. He returned in 1903 to start the foundry at an Ordnance works in the Midlands, where he remained for some years.

MR. JAMES M'DOUGAL WATT, chairman of the West Lothian Steel Foundry Company, Limited, Armadale, died recently, in his 88th year. Mr. Watt served for many years with the London & Glasgow Shipbuilding Company in Glasgow. He went to Armadale in 1900, and since then had been associated with various industrial enterprises.

MR. ROBERT WILKINSON, a retired iron-ore manager who was well known in industrial circles in West Cumberland, died at Cleator Moor recently, at the age of 91. He had resided in the district all his life. Mr. Wilkinson worked as a miner before being appointed manager of the Glebe Mines, Cleator Moor, 55 years ago, a position he held until the mines closed down. Soon after he was appointed manager of the Syke House mines at Bigrigg, and he subsequently became manager of the St. John's mines, Bigrigg, a position he held until his retirement, 23 years ago.

WORLD MINERAL RESOURCES

A strong committee of geologists and mineralogists, under the chairmanship of Sir Thomas Holland, which has been inquiring into the available sources of information concerning mineral and metal resources other than coal and petroleum, is drafting a report in which data and proposals will be submitted to the Council of the British Association on the problem of establishing international agreement and organisation concerning natural resources. An international organisation to survey, and later to control, the distribution of raw materials is regarded as one of the most important problems of post-war reconstruction.

CONTROL OF MAGNESIUM

The Minister of Aircraft Production has made the Control of Magnesium (No. 4) Order, 1942, which came into force on December 31. It codifies the Control of Magnesium Orders (Nos. 1-3) and increases the price of D.T.D. 325, thus standardising the price of all unfabricated magnesium and magnesium alloys. It also reduces the maximum price of magnesium powder to 4s. per lb. for all grades, and specifies controlled prices of magnesium billets and rolling slabs.

STANTON *Dale* REFINED PIG IRON

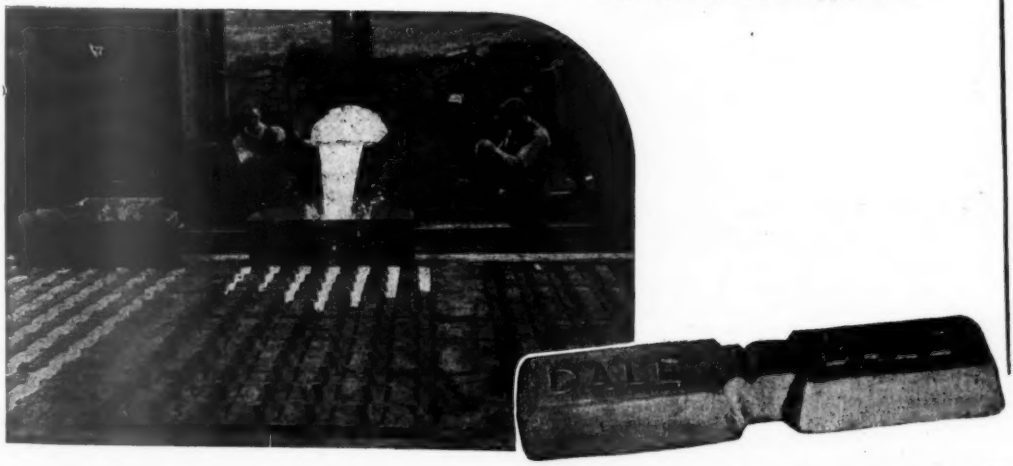
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

NEWS IN BRIEF

JANUARY 21 is the last day for receiving proofs in connection with a dividend to be paid by Walter Arnold Blackburn, 29, Broadway North, Walsall, retired ironfounder. Mr. R. K. Clark, 37, Temple Street, Birmingham, is the trustee.

THE MINISTER OF SUPPLY, Sir Andrew Duncan, has decided to bring the ball and roller bearing industry under formal control, and he has appointed Mr. C. Maxwell Norman to be Controller of Ball and Roller Bearings. The Bearing Control is located at Steel House, Tothill Street, London, S.W.1.

THE COMMITTEE which the Federation of British Industries has set up (under the chairmanship of Sir William Larke) to consider the question of industrial research, has reached certain preliminary decisions with regard to its programme of work. The primary task of the Committee is to stimulate the utmost possible interest in industrial research.

HAMMOND LANE FOUNDRY COMPANY, LIMITED, Dublin, announces the acquisition of three new associates—Fyffe Couplings (Ireland), Limited, Dublin; Douglas Iron Works, Strabane, Northern Ireland, and Wellington Hollow Ware, Limited, Belfast. The Hammond Lane group now comprises nine concerns.

COMPANIES which are being wound up voluntarily in accordance with a recent decision of Imperial Chemical Industries, Limited, include Curtis's & Harvey, Limited, Elliott's Metal Company, Limited, Allen Everitt & Sons, Limited, John Bibby, Sons & Company (Garston), Limited, British Copper Manufacturers, Limited, and the Broughton Copper Company, Limited.

FOURTEEN EMPLOYEES of Guest, Keen & Nettlefolds, Limited, Cardiff, have been presented by the company with long service certificates, together with monetary awards. They are: J. W. Corfield, C. Jones, H. Archer, E. Spooner, F. Jones, W. R. Thomas, R. Phillips, T. A. W. Davis, E. Brown, Tom Williams, A. Doody, H. M. Bailey, E. Tyers, and O. S. Osmond. Their record of service between them totals 604 years.

A SURVEY conducted by the Ministry of Supply in collaboration with an advisory panel of the electrical industry, has shown the need for paying special attention to the selection and loading of electrical equipment so that it is used to the limit of its capacity to meet immediate war needs. Practical steps to give effect to this policy have been discussed with the electrical manufacturers, who are co-operating with the Ministry.

AT THE ANNUAL MEETING in Dublin of the Irish Aluminium Company, Limited, Mr. S. M. Minch, chairman, said it was proposed to embark on a new line of production, namely diecast hollow-ware, which, judging by the demand for ware of high quality and orders in hand, would keep the factory engaged. Owing to the difficulty of obtaining materials the manufacture of electric kettles had ceased for the time being. The vacuum flask making department had been closed, but it was hoped to reopen it soon.

SIR CHARLES CRAVEN has been appointed industrial adviser to the Minister of Production, and in order that he may undertake these responsibilities the Minister of Aircraft Production has agreed to release him from his duties on the Aircraft Production Council. Sir Percy Mills has been appointed Chief Adviser to the Minister on production progress; he will continue to serve as the representative of the Minister of Production on machine tool questions and will also be in charge of the allocation of machine tools as administered by the Ministry of Production.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"PARKERIZED"—Partly wrought common metals. PYRENE COMPANY, LIMITED, Great West Road, Brentford, Middlesex.

"GEM"—Rotary wire brushes. A. LUSON & SONS, LIMITED, Climax Works, Standard Road, Park Royal Road, London, N.W.10.

"HYPERLOY"—Electric transformers and choke resistances. WRIGHT & WEAIRE, LIMITED, 740, High Road, Tottenham, London, N.17.

A PROPELLER, A SHIP AND A COMBAT TANK (devices) and the words "AIR," "SEA," "LAND"—Metals, machine couplings, etc. ARTHUR PATTISON, LIMITED, Allesley, Coventry.

"DIABOR"—Rock and earth drilling machines, pumps, tools, etc. SVENSKA DIAMANTBERGBORRNINGS AKTIEBOLAGET, c/o Cruikshank & Fairweather, 29, Southampton Buildings, Chancery Lane, London, W.C.2.

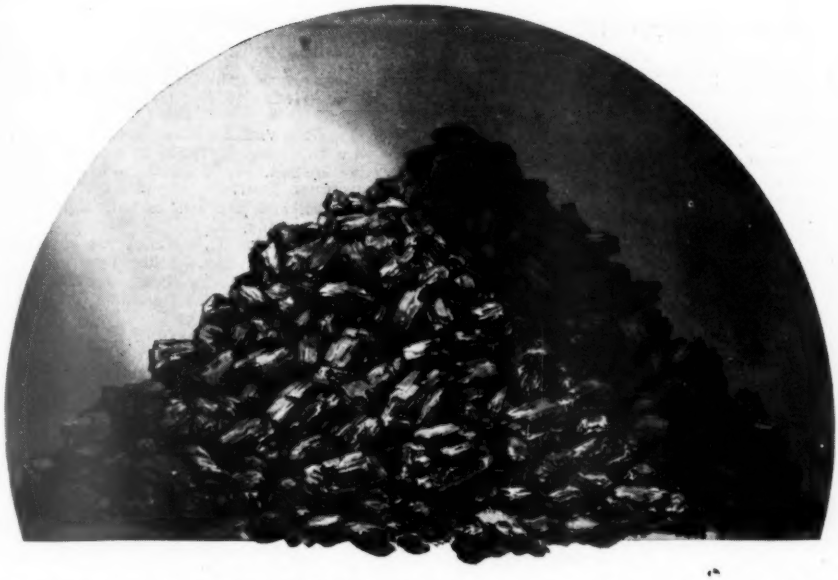
PERSONAL

MR. A. AUGSTEIN, formerly manager, has been elected a director of F. & M. Supplies, Limited, 21-23, Coldharbour, London, E.14.

SQUADRON-LEADER HENRY HAROLD BROMILOW MOULD, only son of Mr. and Mrs. Harry Mould, of Walsall, has been reported "missing, believed killed," in action. Before joining the Forces Squadron-Leader Mould was with his father in the business of Alfred H. Mould & Sons, Limited, ironfounders, of Walsall.

MR. B. LOCKSTEISER has been appointed by the Minister of Aircraft Production to be Director of Scientific Research in succession to Dr. D. R. Pye, who has relinquished his post to take up the appointment of Provost of University College, London. Mr. Locksteiser has served in the Air Ministry and Ministry of Aircraft Production since 1920.

MR. ALEXANDER GEORGE GRANT, for the past four years general manager of the Whessoe Foundry & Engineering Company, Limited, Darlington, has joined the board of that company. A graduate of Leeds University, Mr. Grant has been associated with the company since 1930, and has taken a leading part in its recent technical developments.



How much of the Nation's fuel is being WASTED?

The advantages of Insulation include:—

- **Conservation of Fuel.**
- **Working Heat attained in less time.**
- **More Even Heat Distribution.**
- **Improved Control of Temperature.**

Efficient Insulation can permit greater output — lower production costs — improved furnace control & operating conditions.

EVERY works — every citizen — is now in the front line in the battle for fuel. Heat losses are a burdensome waste which must be prevented wherever possible. The gravity of the situation demands that even the most essential war industries should rigidly conserve fuel. Wherever insulation is applicable an efficient system should be installed — without delay. The 'Amberlite' range of insulating bricks covers the requirements of every industry and large quantities are available from stock.

G.R. insulation specialists are ready to assist users in the choice of materials to meet particular conditions of service.

INSULATE

HEAT-GENERATING PLANTS IN EVERY INDUSTRY WITH

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FIREBRICKS · BASIC BRICKS · ACID RESISTING MATERIALS · PLASTICS

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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Universal Foundry Supplies—£10,000. P. J. Manison, 18, Austin Friars, London, E.C., subscriber.

Lancashire Machinery & Scrap Company, 26, Cross Street, Manchester, 2—£5,000. S. and T. R. Bell.

Evanco Engineering Company (Walthamstow)—£2,000. F. H. Evans, 138, Plashet Road, London, E.13; S. and L. Guttridge, L. M. Evans, and W. H. MacMaster.

E. Siegrist, 39, Berners Street, London, W.1—Manufacturers of and dealers in electric cables, insulating materials, etc. £5,000. E. Siegrist, S. F. Hanks, and J. H. S. Haas.

British Rollmakers Corporation—£100, which may within three months be increased to £500,000. To acquire the preference and ordinary shares of C. Akrill & Company, Limited, and R. B. Tennent, Limited, and to carry on the business of roll manufacturers, iron, steel and brass founders, etc. Solicitors: Wragge & Company, Birmingham.

COMPANY NEWS

(Figures for previous year in brackets.)

Thos. Bolton & Sons—Interim dividend of 2½% (same).

Universal Grinding Wheel—Interim dividend of 10%, tax free, on the ordinary shares. It is not anticipated that a final dividend will be paid.

A. E. Jenks & Cattell—Net profit to August 1, £28,797 (£16,166); ordinary dividend of 10% (7½%), tax free; forward, £51,684 (£33,286).

British Rola—Trading profit to March 31, after depreciation, £25,377 (£17,225); net profit, £7,483 (£6,330); ordinary dividend of 8¾%, £6,250 (same); forward, £3,694 (£2,899).

Turner & Newall—Net profit for the year to September 30, £530,840 (£506,472); dividend on the ordinary stock of 12½% (same); welfare trust, £10,000 (same); general reserve, £100,000 (same); forward, after preference dividend, £78,440 (£65,189).

CONTRACTS OPEN

The date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

London, S.W., January 29—Sewer castings, tools, iron, steel, etc., for six and 12 months from March 31, for the Lambeth Borough Council. Mr. G. H. Buckett, Town Hall, Brixton Hill, London, S.W.2.

London, S.E., February 3—Drain pipes, sewer ironwork, tools, iron, etc., for the Southwark Borough Council. Mr. D. T. Griffiths, town clerk, Southwark Town Hall, Walworth Road, London, S.E.17.

Rainford, February 12—Iron castings, etc., for 12 months from April 1, for the Urban District Council. The Surveyor, Council Offices, Rainford, Lancs.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

549,652 WICKWIRE SPENCER STEEL COMPANY. Stranded wire rope, and methods of making the same.

549,689 JESSON, W. F., and IMPERIAL CHEMICAL INDUSTRIES, LIMITED. Apparatus for the treatment of metal and like articles with liquids or vapours for degreasing.

549,889 METCALFE, H. Means for supplying heated air to furnace and the like fires.

549,909 STEVENS, A. H. (Pittsburgh Steel Company). Axles for railroad cars and the like, and methods of making the same.

549,975 MINERALS SEPARATION, LIMITED. Froth flotation concentration of ores.

550,034 SIGNODE STEEL STRAPPING COMPANY. Joints for metal straps.

HOLLOW-WARE MANUFACTURE IN BELFAST

War conditions have given Belfast a new industry. Early in 1942, plant for the manufacture of hollow-ware was purchased in England by the Hammond Lane Foundry Company, Limited, Dublin, whose intention was to set it up in their Pearse Street works and to wait until the raw material supply position became easier. An exit permit, however, could not be procured. Negotiations were opened with the Northern Ministry of Commerce and the outcome is that the plant has been diverted to Belfast to be operated by a new company styled Wellington Hollow-Ware, Limited.

PURCHASE TAX ON IRON AND STEEL HOLLOW-WARE

The Commissioners of Customs and Excise have decided that in future the following types of bucket and pail of enamelled hollow-ware and other iron and steel hollow-ware shall be chargeable with purchase tax at the rate of 16⅔ per cent. under Class 9:—

Buckets and pails of domestic pattern weighing less than 72 lbs. per dozen (including fire, industrial and dairy buckets and pails), and other buckets and pails, irrespective of weight, of a kind used for domestic purposes.

MR. EDGAR HOLLADAY, managing director of Garton & King, Limited, Exeter Foundry, Tan Lane, Exeter, died recently, aged 74. He became a partner with his brother in the firm in 1900, and he continued to take an active part in the business up to the time of his death.

from a few pounds up to **25 TONS –**

ELECTRIC STEEL CASTINGS

Why not discuss your steel casting problems with us? . . . . . All our experience is at your disposal

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